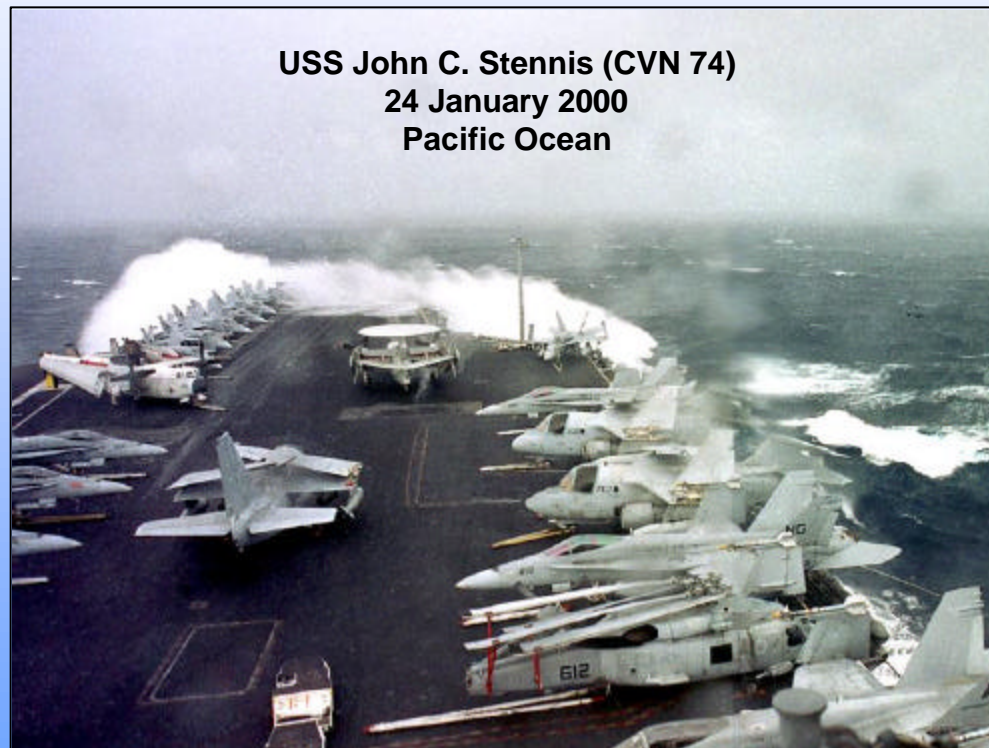




# *Weather Web*

## A View from the Naval Research Laboratory



**Dr. John McCarthy**  
**NRL Monterey**  
**[mccarthy@nrlmry.navy.mil](mailto:mccarthy@nrlmry.navy.mil)**



# *Weather Web*

## **Motivation:**

- Tell the warfighters what is going on out there now!
- Individual data sources from the target area are not assimilated together.
- Problem is compounded by complex terrain and littoral areas.



# *Weather Web*

## **Objective:**



Instantly provide a physically consistent weather picture for the target area to all service commands, mission planners, and warfighters.

- 0-2 hours weather information
- Optimally fuse all data sources
- Constant update



# *Weather Web*

## Approach:

- Value of the observed data will diminish as time elapses
- Physics-based AI data fusion
- Handle unusual data sources 
- Telescoping strategy extends time and space scale 
- Experiments-based approach
  - Warfighter feedback important

**Mt. Greylock & Ft. Benning**





# *Weather Web*

## **Products:**

- Intuitive and easily used directly by the end users
- Continuously updated
- Automated product generation
- Confidence level
- Available via web to all Services

Nowcast



# *Weather Web*

## **Weather Web connects to the other SSW components:**

- InformationWeb and Integration Testbed
- ImageWeb/SimulationWeb
- WeaponsWeb

## **Weather Web supports S&T thrusts:**

- Joint Vision 2020: *Complete Common Situational Awareness*
- Coordinated Service efforts between Army, Navy, and AF
- Joint program addressing technology gaps
- Evolve our “Web-Centric” capabilities via two testbeds
- Future ACTD and Service sponsor



# *Weather Web*

## **Challenging Scientific Issues Facing Weather Web**

- What is the optimum number of sensors and frequency of measurements to meet nowcasting requirements?
- Given the myriad number of sensor types, how do we determine the most appropriate suite to serve our set of warfighters?
- How do we best serve multiple needs of the Army, Navy, and Air Force at different scales, and to correctly meet the needs of their respective warfighters?
- Data assimilation and short-term forecast techniques will need to be fine-tuned to meet the longer-term needs of Weather Web





# *Navy Strategy for the Future*

## *Telescoping Global/Regional/Tactical Systems*

The US Navy and Marine Corps Corporate Laboratory

9

### **NOGAPS: (Fleet Numerical)**

- Global coverage
- 1–10d forecaster guidance

### **COAMPS: (Fleet Numerical)**

- High resolution, nested regional coverage
- 0–72h forecaster guidance

### **COAMPS-OS: (Theater Centers)**

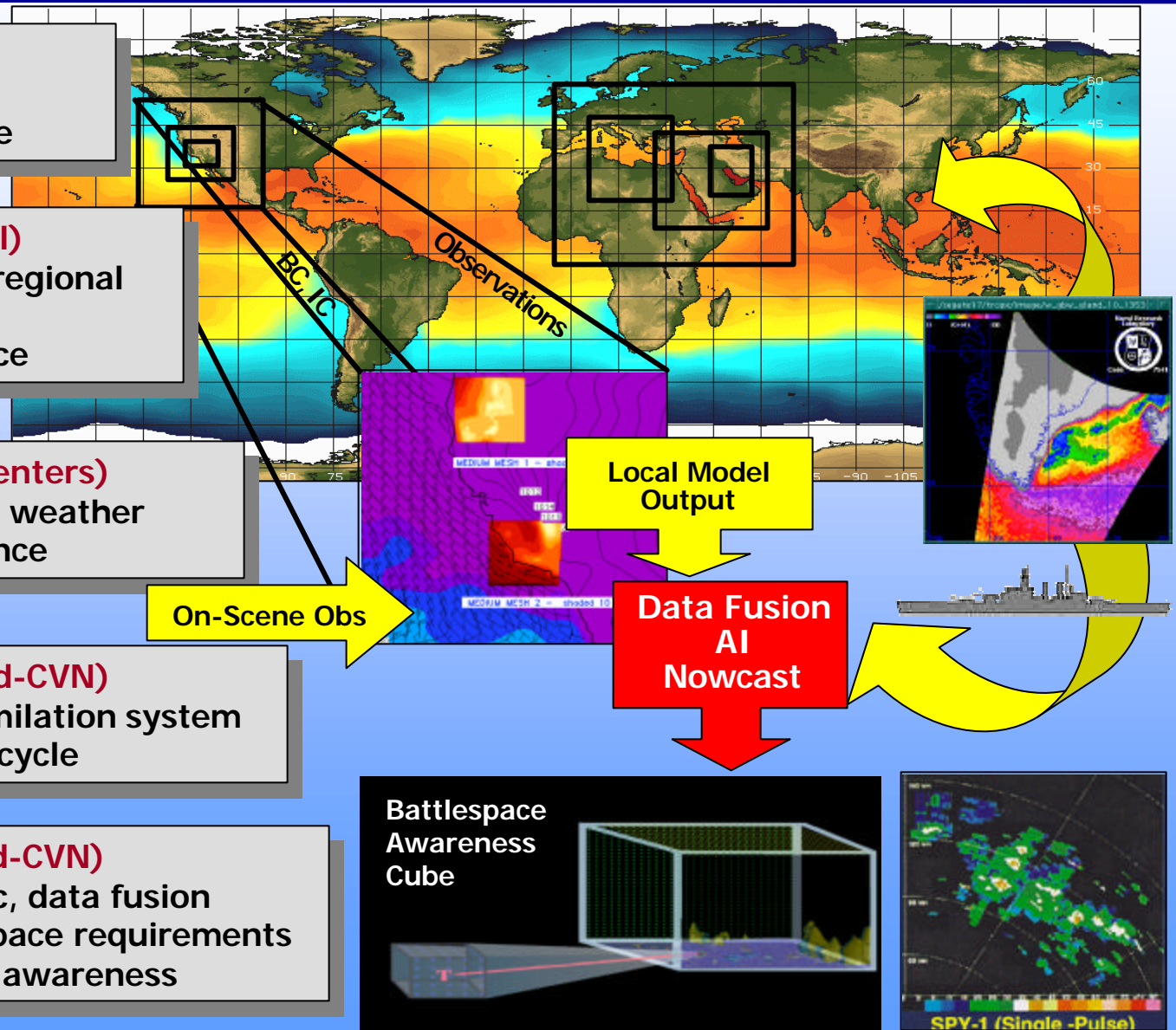
- On-scene tactical-scale weather
- 0–48h forecaster guidance

### **COAMPS-OS: (Shipboard-CVN)**

- Battlegroup data assimilation system
- 12h data assimilation cycle

### **NOWCAST: (Shipboard-CVN)**

- Real-time, automatic, data fusion
- Warfighter time & space requirements
- Common situational awareness



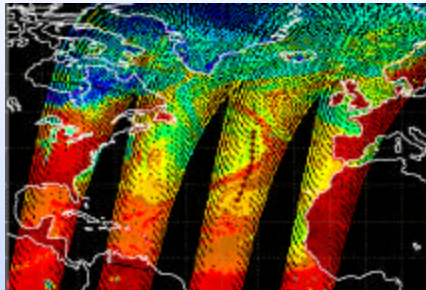


# *Utilize a Complementary Suite of Sensing Systems*

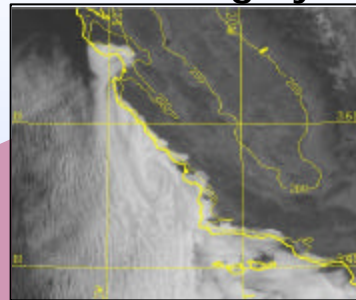
The US Navy and Marine Corps Corporate Laboratory

10

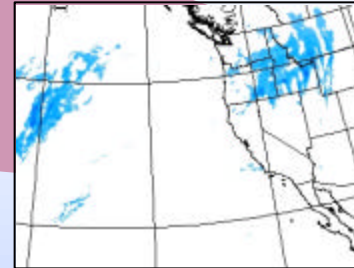
Satellite Data



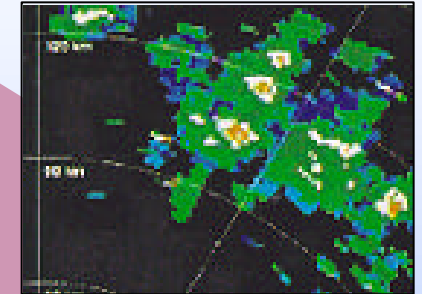
Cloud Imagery



Rain Rate



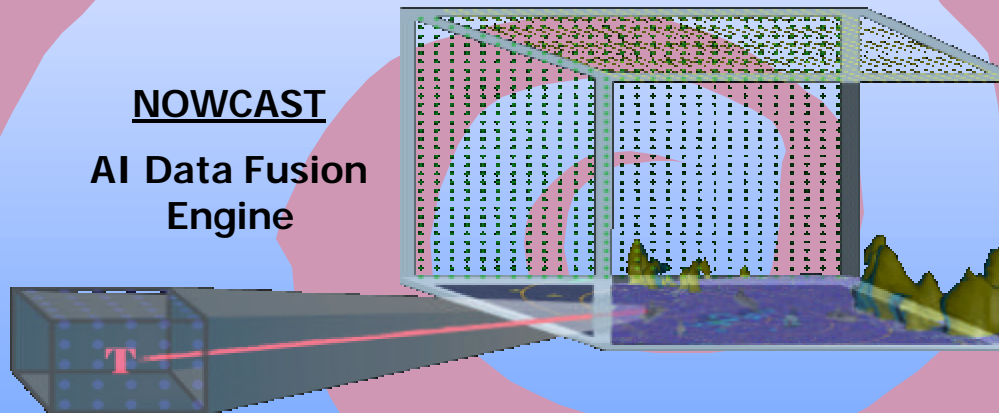
Radar Data



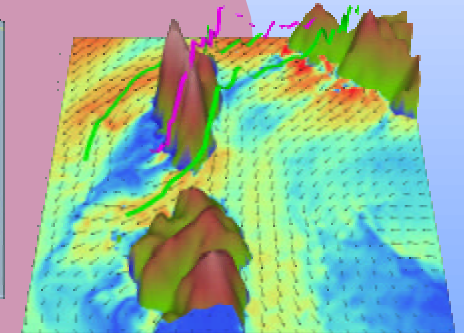
UAV



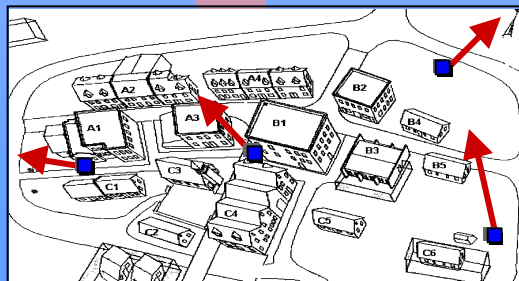
NOWCAST  
AI Data Fusion  
Engine



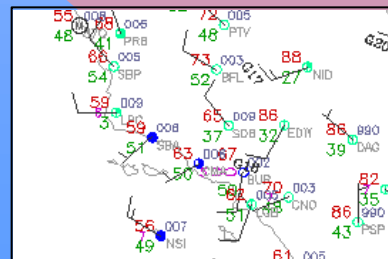
Model Products



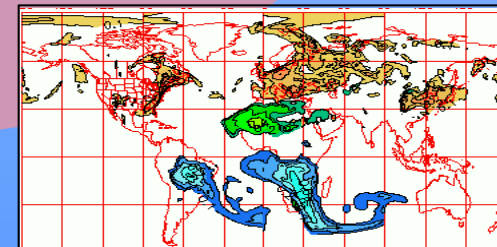
Weather Web



Conventional Obs



Aerosol Data

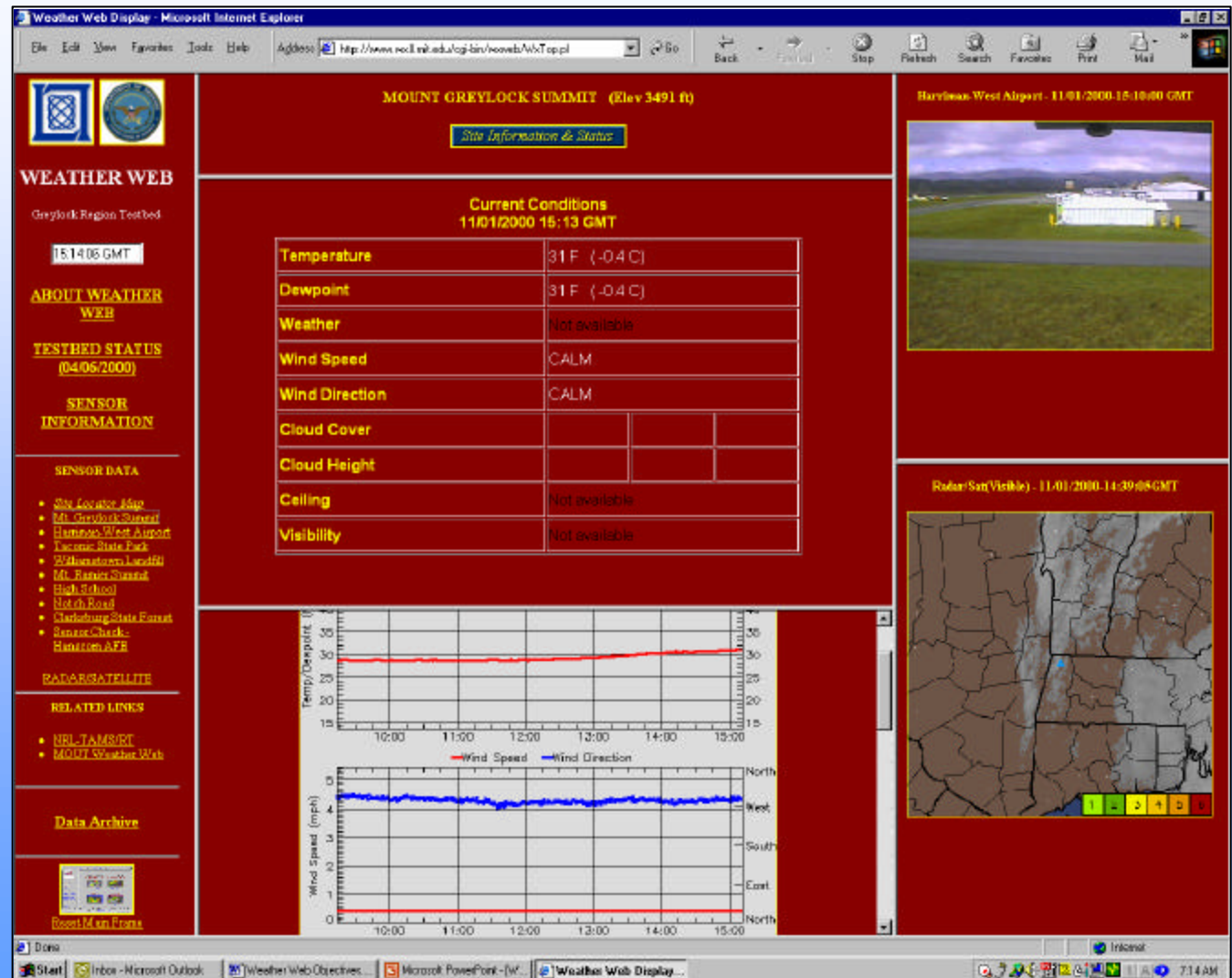






# *Mt. Greylock, MA Site*

- Unique to WxWeb
- Focused on R&D issues associated with accuracy requirements for tactical information
- Joint Army, Navy, AF
- MIT/LL as partner





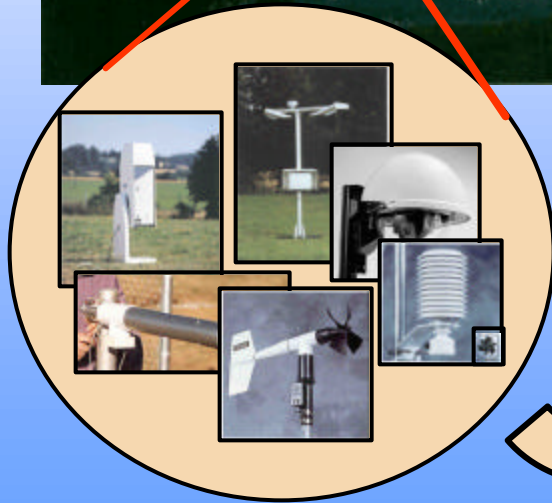
# *ARL in Collaboration with MIT/LL, Navy and AF*

## *Developing on-scene web data ingest and demonstrating value-added of surface observations*

The US Navy and Marine Corps Corporate Laboratory

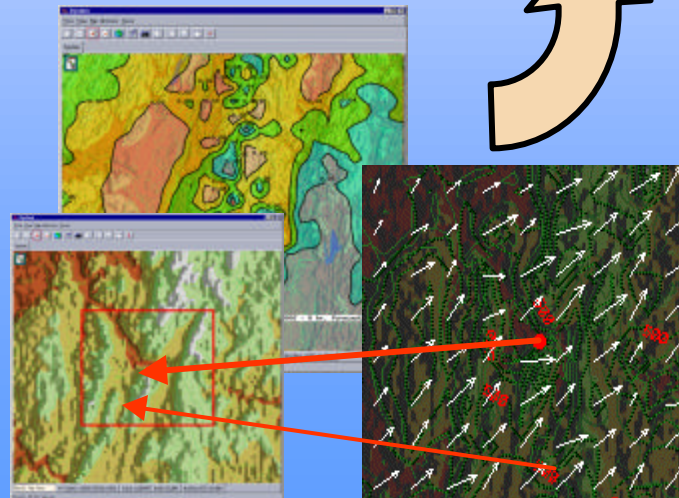
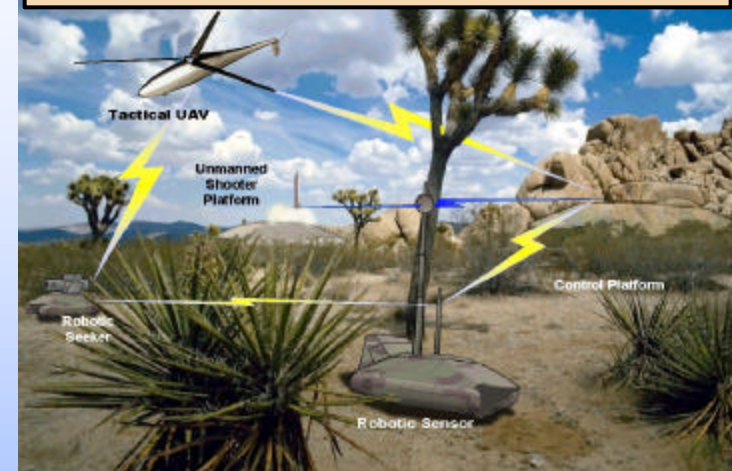
12

**WxWeb Data Site - Complex Terrain**



**Today - WxWeb On-Scene Met Sensors**

**Future Combat System - On-Scene Sensors**



**Tomorrow - A new Nowcast model is required to fuse on-scene met observations from robotic, on-scene and remote sensors – and optimize battlefield sensor placement**



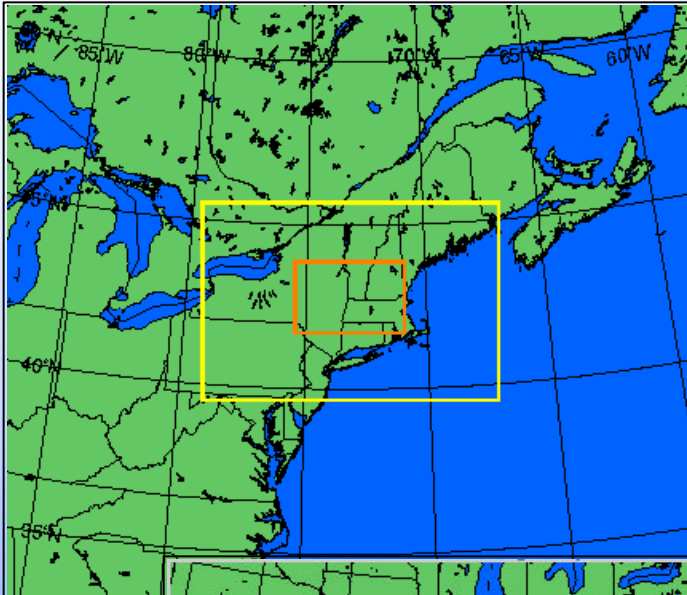




# *Navy COAMPS-OS Support*

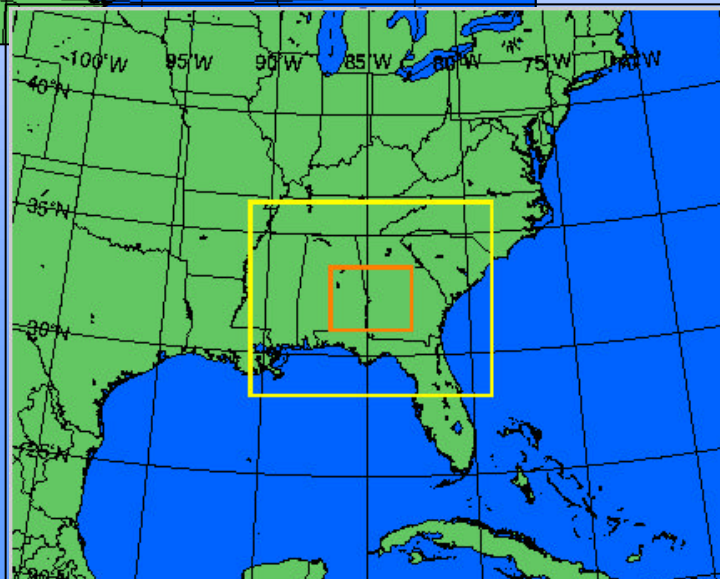
The US Navy and Marine Corps Corporate Laboratory

13



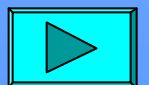
## Mt. Greylock

- 6 km resolution
- 12 hr forecast
- Twice a day
- Assimilate on-scene observations
- Output data to MIT/LL and AF



## Ft. Benning

- 6 km resolution
- 48/24 hr forecasts
- Twice a day
- Assimilate on-scene observations
- Output data to MIT/LL and AF

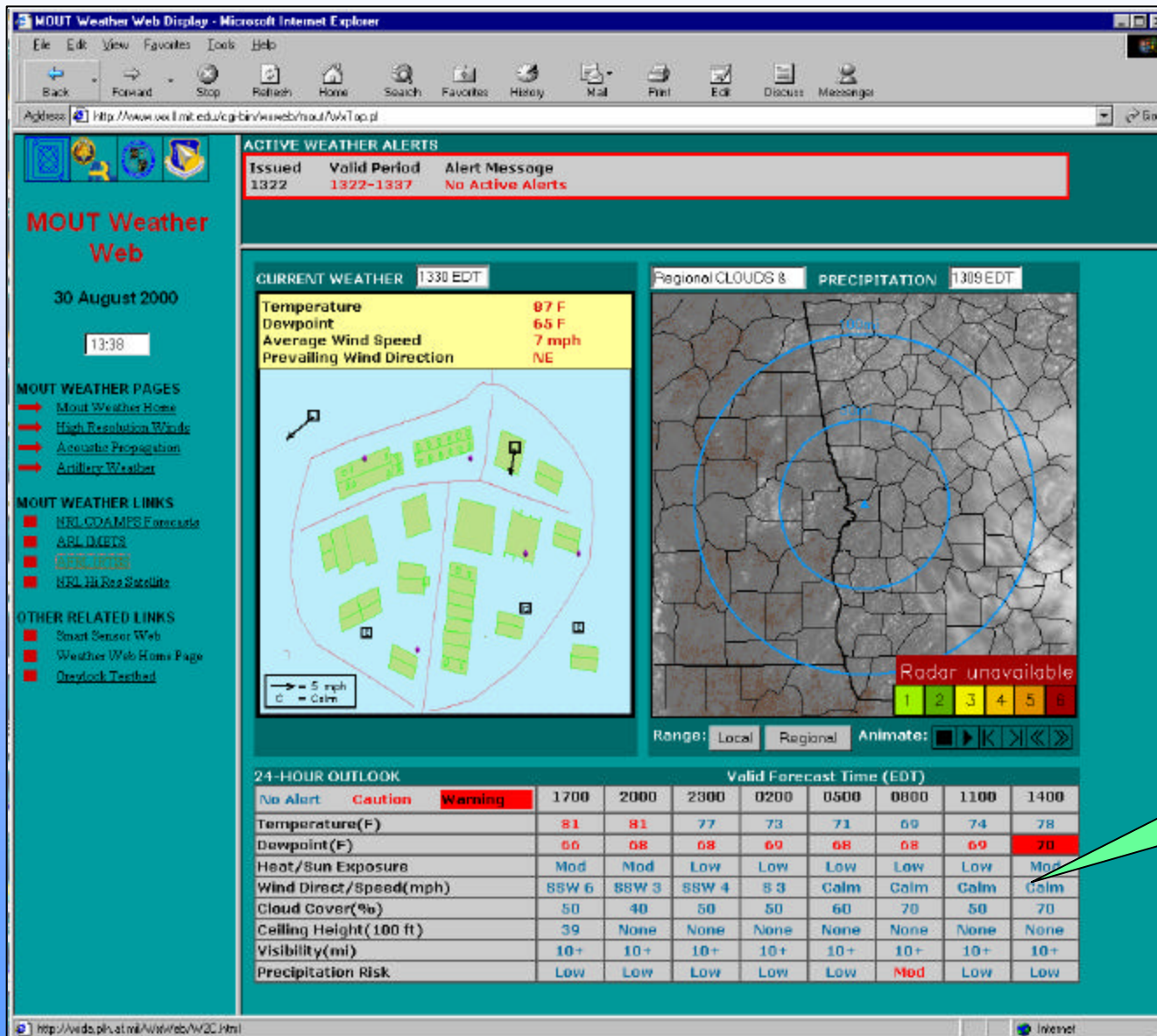




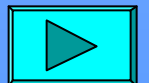
# Ft. Benning MOUT Site

The US Navy and Marine Corps Corporate Laboratory

14



COAMPS  
forecast data





# Air Force IRTSS Product

The US Navy and Marine Corps Corporate Laboratory

15

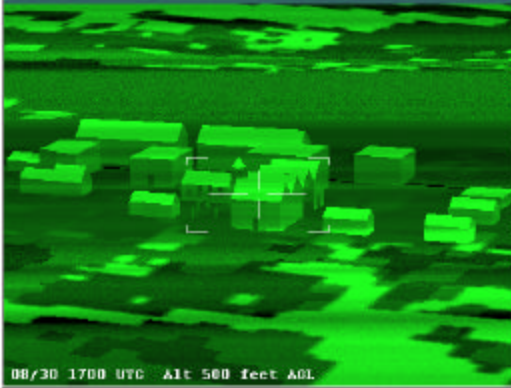
APRL IRTSS - Weather Web Controller - W2C - Microsoft Internet Explorer

Address: <http://wids.pla.af.mil/WWeb/W2C.html>

Weather Data used to create images:

Bar Pres (mb)	Temp (C)	Rh (%)	Wd Sp (m/s)	Durt (deg)	Vis (km)	Precip mm/hr	P	Cloud Data amt L amt M amt H
1013.7	25.7	67.6	1.9	28.2	90.0	0.00	0	0.6 2 0.0 0 0.0 0

**FLIR View from the southeast**



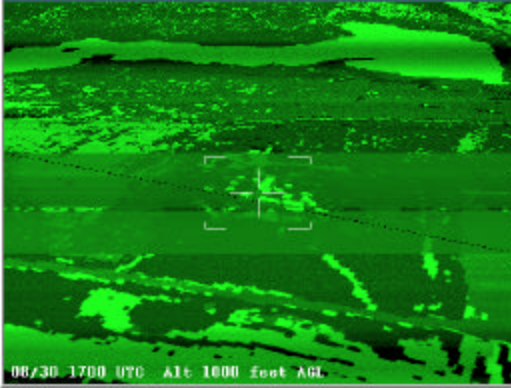
08/30 1700 UTC Alt 500 feet AGL

[IRTSS IMAGE](#)

**PRODUCT DESCRIPTION**

Image shows what the observer (located at GL 06748300) will see of the objective at the specified date/time. The image is representative of a narrow field of view from the Apache's FLIR.

**FLIR View from the northwest**



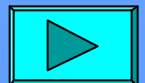
08/30 1700 UTC Alt 1000 feet AGL

[IRTSS IMAGE](#)

**PRODUCT DESCRIPTION**

Image shows what the UAV (located at GL 06278420) will see of the objective at the specified date/time. The image is representative of a wide field of view from an Apache's FLIR.

Uses COAMPS  
forecast data





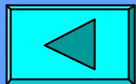
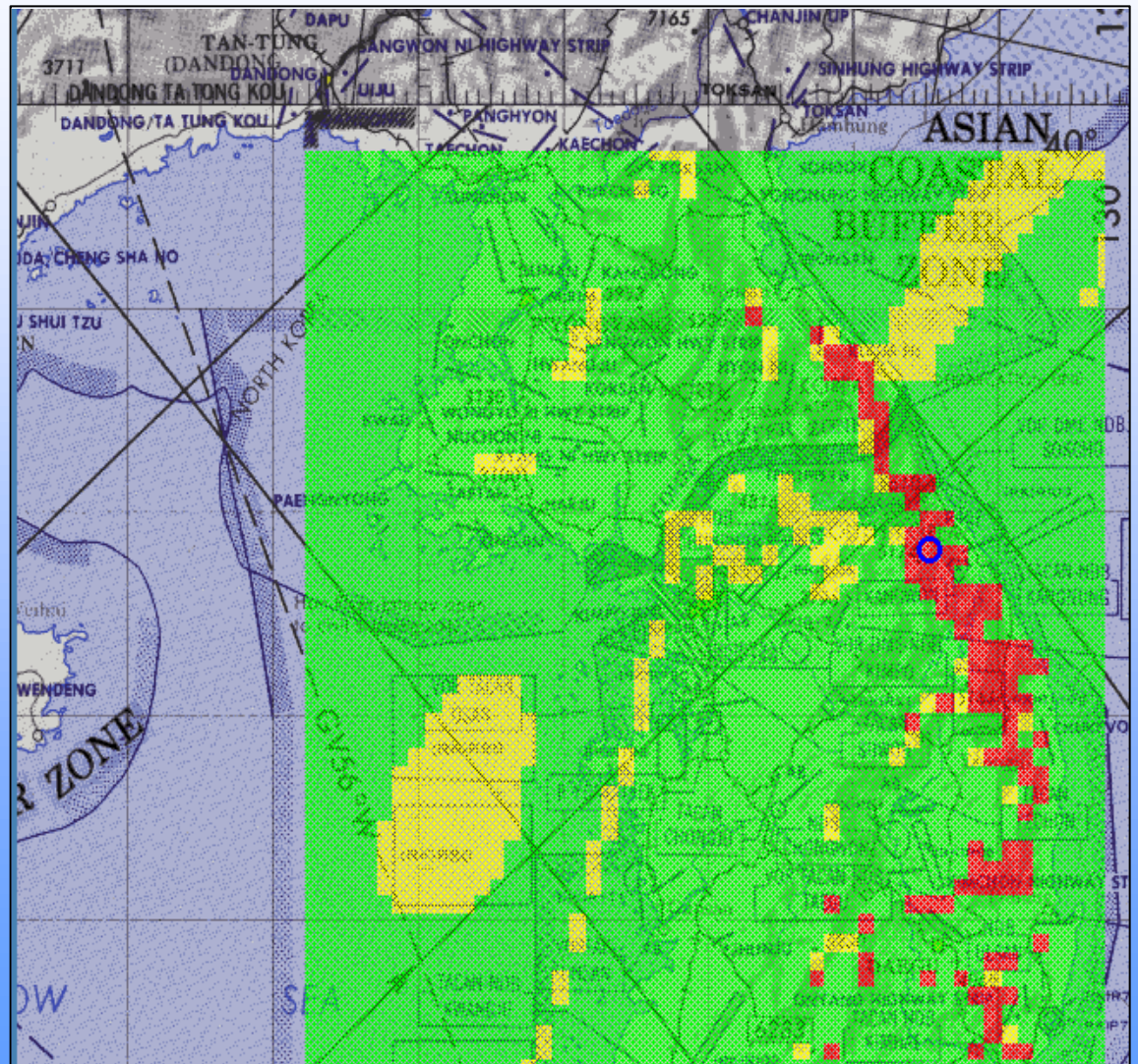


# *Army Integrated Meteorological System (IMETS)*

The US Navy and Marine Corps Corporate Laboratory

16

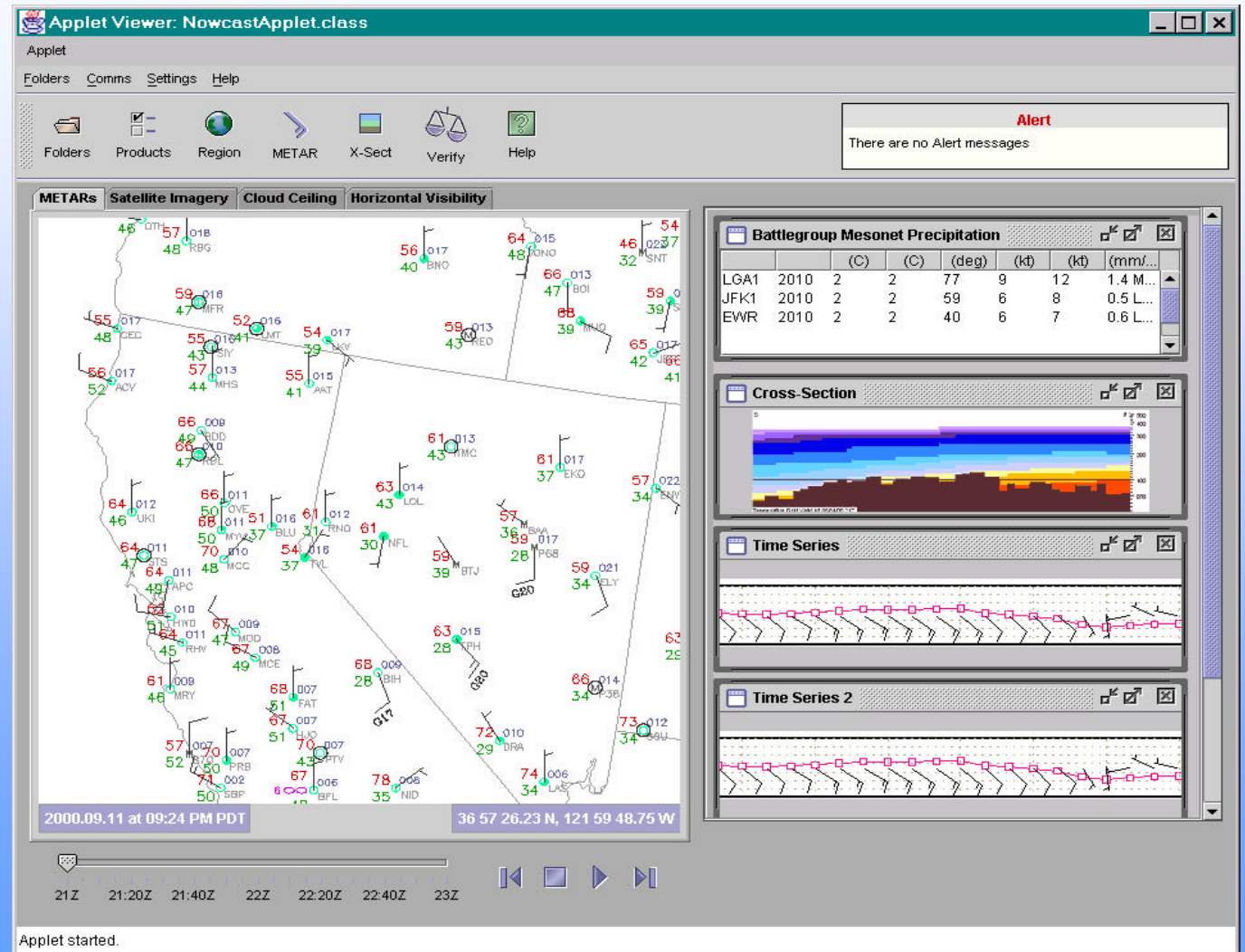
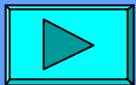
- Army Battlescale Forecast Model (BFM) - AF MM5 and Navy NOGAPS forecasts provide boundary conditions
- Assimilate on-scene weather observations
- IWEDA weather effects for Korea show unfavorable impacts on the Apache helicopter launched Hellfire (laser-guided anti-armor missile) weapon system





# *Nowcast Java Applet Main Window*

- State-of-the-art technology in an easy to use and intuitive interface
- Customize to meet the needs of the warfighter
- Products go directly to the warfighter but the system is owned, configured, maintained, and quality assured by METOC



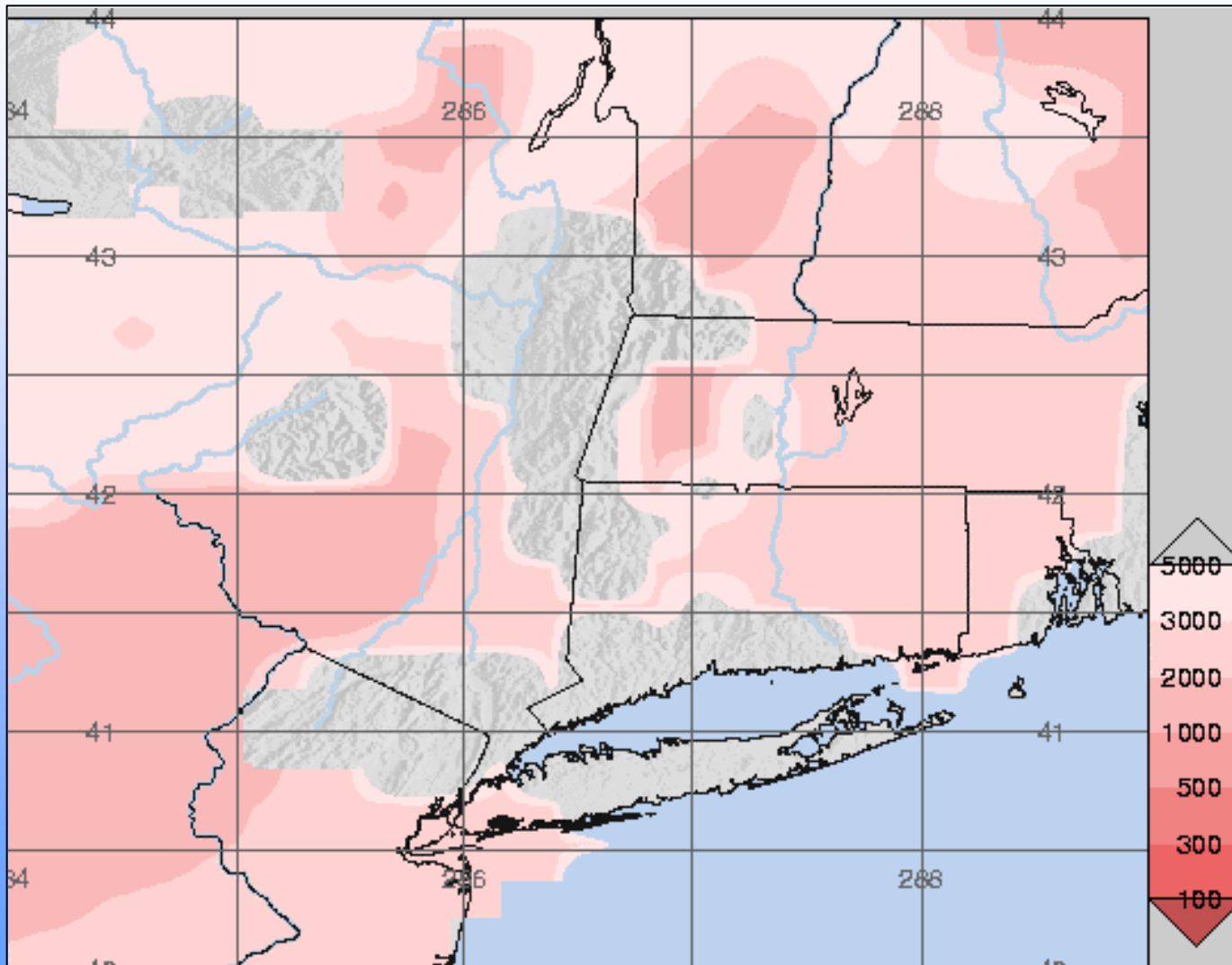




## *Nowcast Example Ceiling Product*

The US Navy and Marine Corps Corporate Laboratory

18



Jennifer Strahl and Dan Geiszler, SAIC

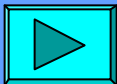
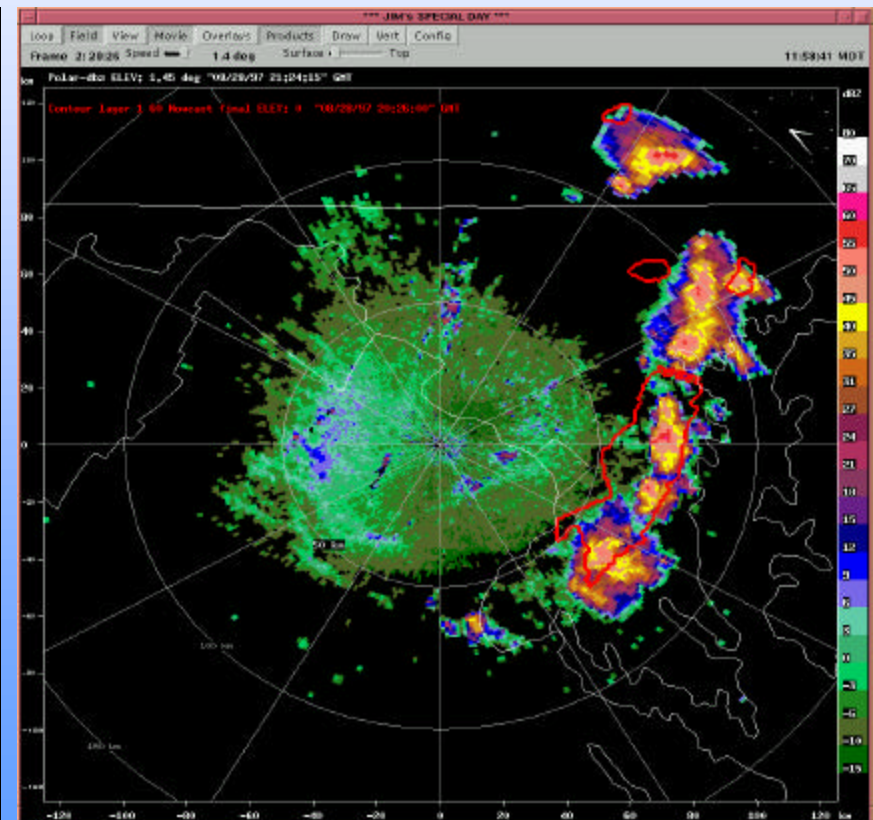
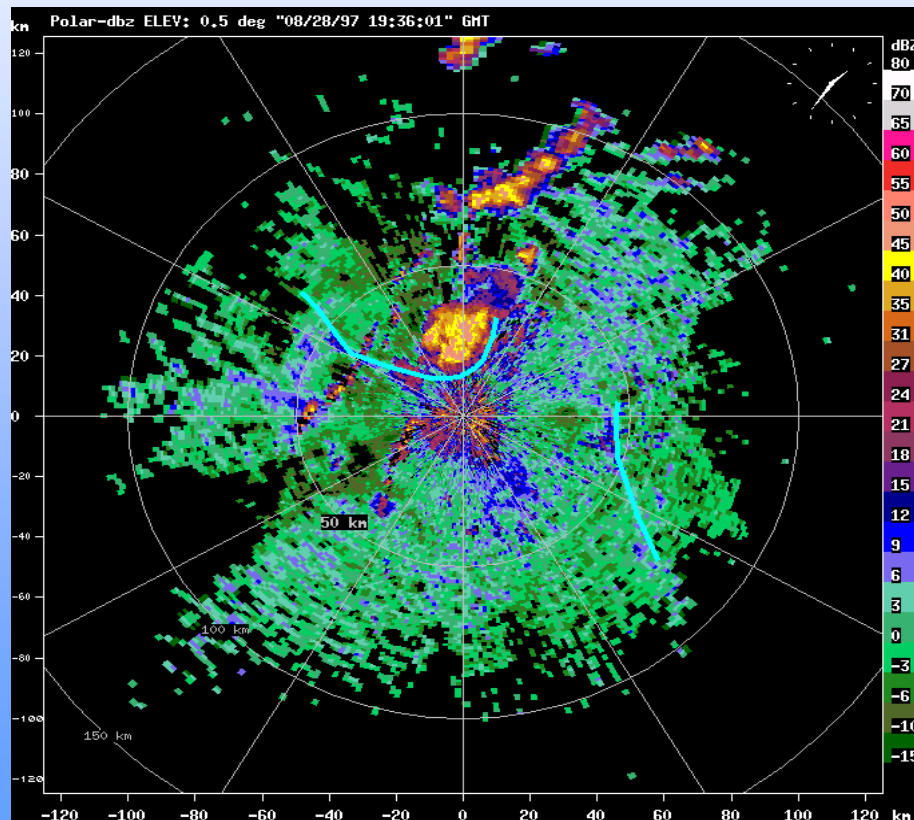


# *NCAR Autowcaster Example*

The US Navy and Marine Corps Corporate Laboratory

19

- Boundary detection and characterization
- Extrapolation to forecast thunderstorm movement, initiation, and decay
- 60 min forecast and verification



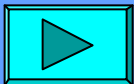
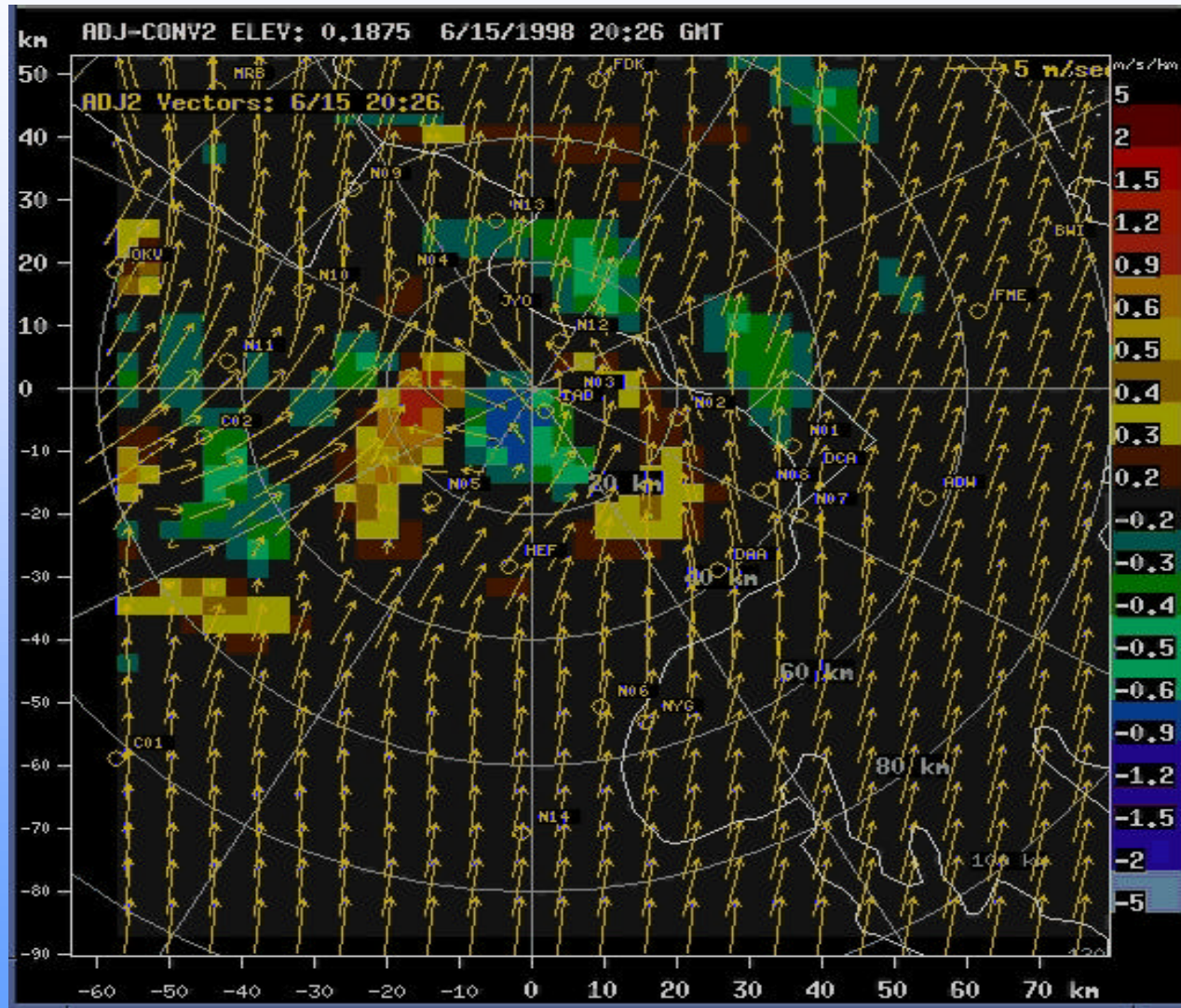
Jim Wilson, NCAR



# *NEXRAD Low-Level Wind Example*

The US Navy and Marine Corps Corporate Laboratory

20



Jenny Sun and Andrew Crook, NCAR





# *A Vision of the Future*

The US Navy and Marine Corps Corporate Laboratory

21

- 3D Hazardous Weather Display
- Requested by warfighters in Nowcast IPT

